



Practical Affordable NO_x Control for Process / Cracking Furnaces

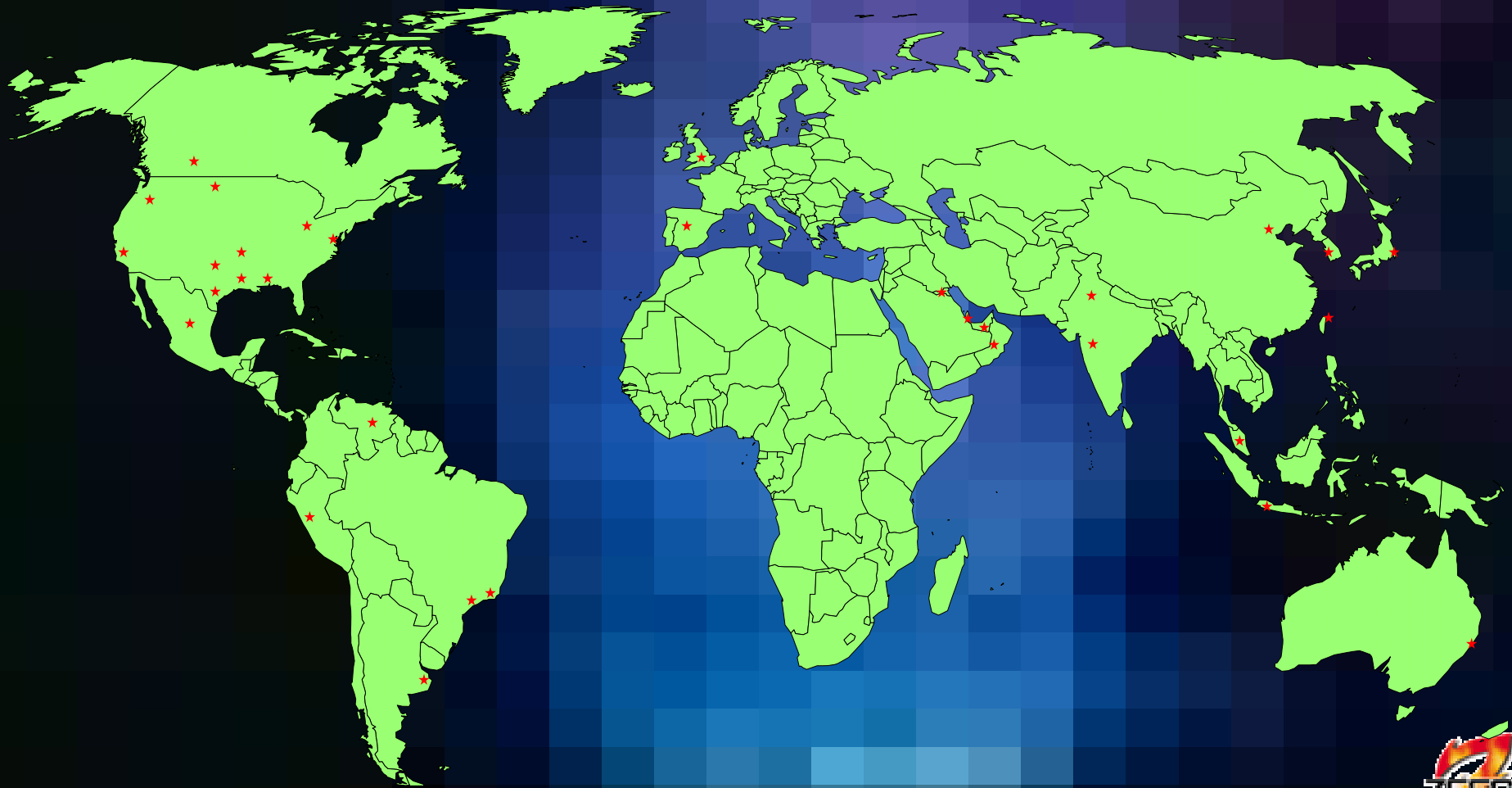
Presented by Scott D. Reed
2003 Texas Showcase Meeting

ZEECO WORLDWIDE

INSTALLATIONS IN OVER 43 COUNTRIES

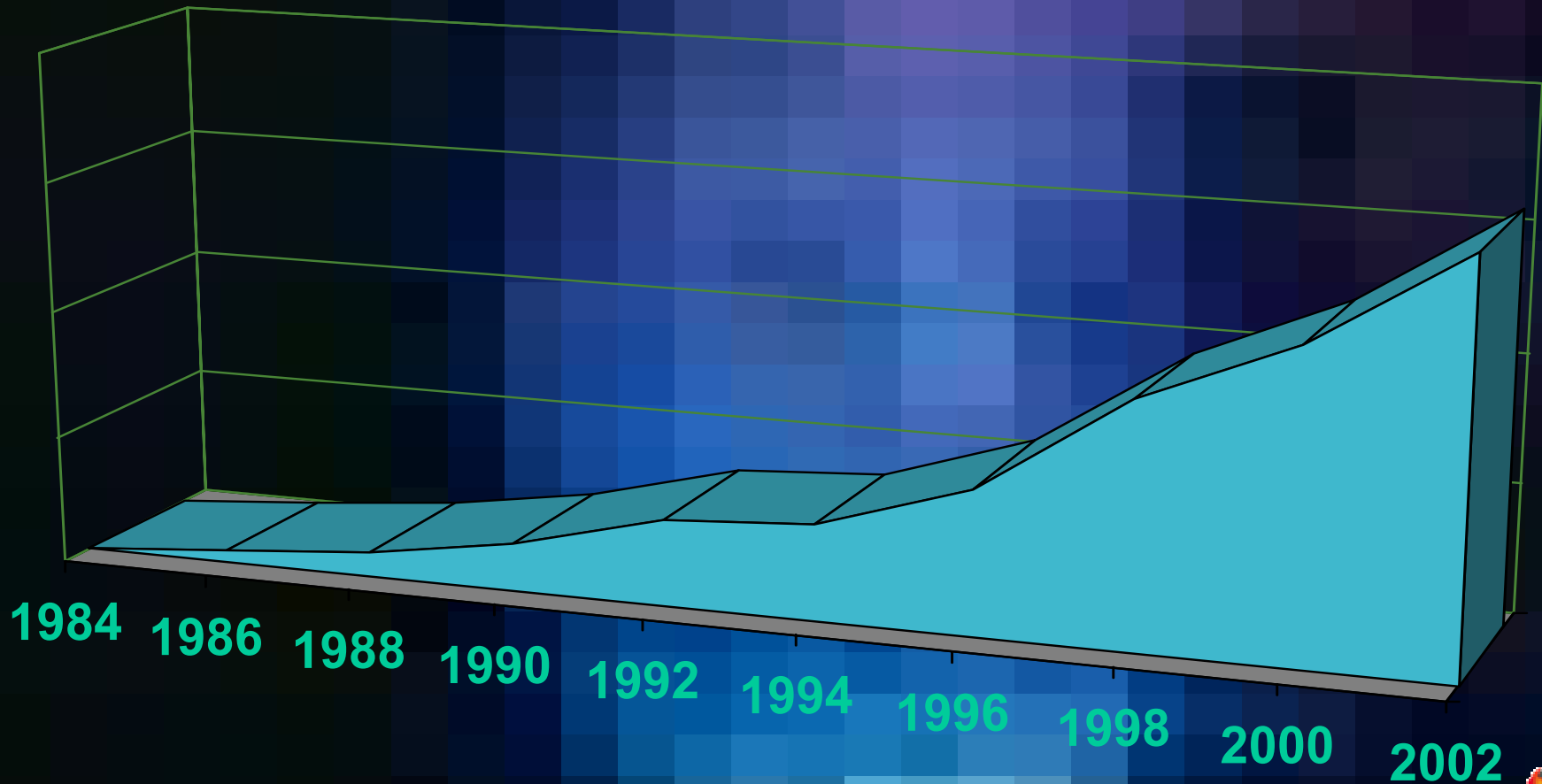
22 INTERNATIONAL LOCATIONS

10 DOMESTIC LOCATIONS



COMPANY GROWTH

- SUSTAINED AVERAGE GROWTH OF 30% PER YEAR SINCE INCEPTION



QUALITY CONTROL

- ISO 9001 ACCREDITED ENGINEERING, MANUFACTURING AND TESTING FACILITY
- ASME SECTION VIII CODE SHOP; U, R & S STAMPS
- UL CERTIFIED
- CE CERTIFICATION IN PROGRESS
- LACK OF WARRANTY CLAIMS



LOW NOX BURNER RETROFIT CONSIDERATIONS

- SMALL FOOTPRINT MINIMIZE REWORK
- EASY TO OPERATE
- SHORT FLAME
- MINIMIZE FLAME TO FLAME INTERACTION
- STABLE ON WIDE RANGE OF FUEL GASES
- LONG LIFE DURABLE CONSTRUCTION
- EASY TO MAINTAIN, NO METAL IN THROAT
- TESTING DEMONSTRATION CAPABILITY
- AFFORDABLE BURNER / SPARES PRICING

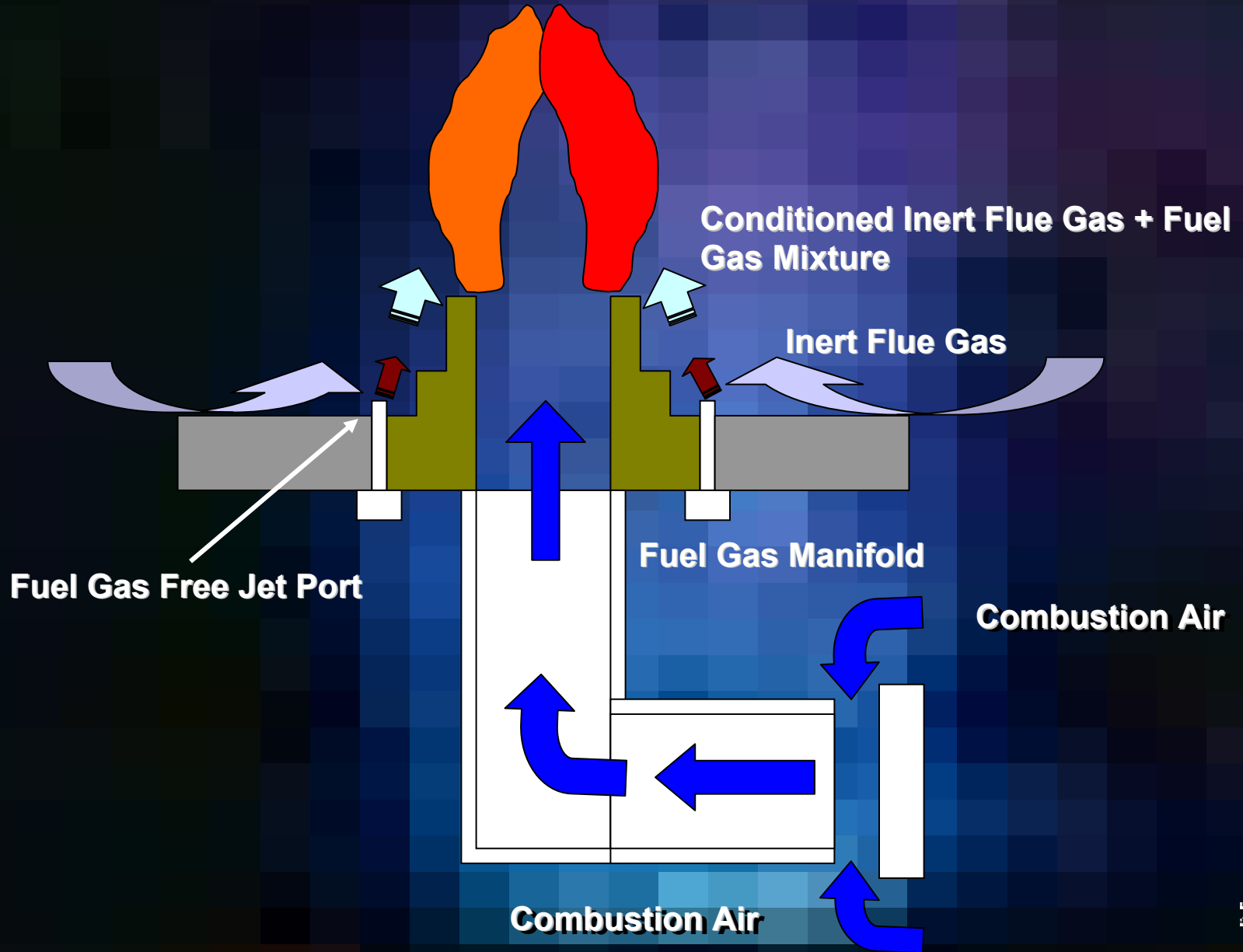


ZEECO FREEJET BURNER DESIGN CRITERIA

- **SMALL FOOTPRINT – FREEJET BURNER HAS NO METAL STABILIZATION DEVICE IN THE THROAT AREA, WHICH KEEPS THE BURNER SMALLER IN DIAMETER AND THEREFORE TYPICALLY RESULTS IN NO FURNACE MODIFICATIONS WHEN RETROFITTING EXISTING FURNACES, SAVING INSTALLATION COST**
- **EAST TO OPERATE – FREEJET BURNER HAS ONE AIR CONTROL HANDLE AND ONE FUEL GAS CONNECTION**



Free Jet Concept



Free Jet

Extreme NOx Reduction

“Free jet” technology is used to mix the maximum amount of internal flue gas with the fuel gas to lower the peak flame temperature of the combustion reaction.



Description of Free Jet

When the fuel gas stream is ejected through the flue gas without passing through an enclosed passageway, approximately twice as much flue gas can be entrained by the fuel gas.



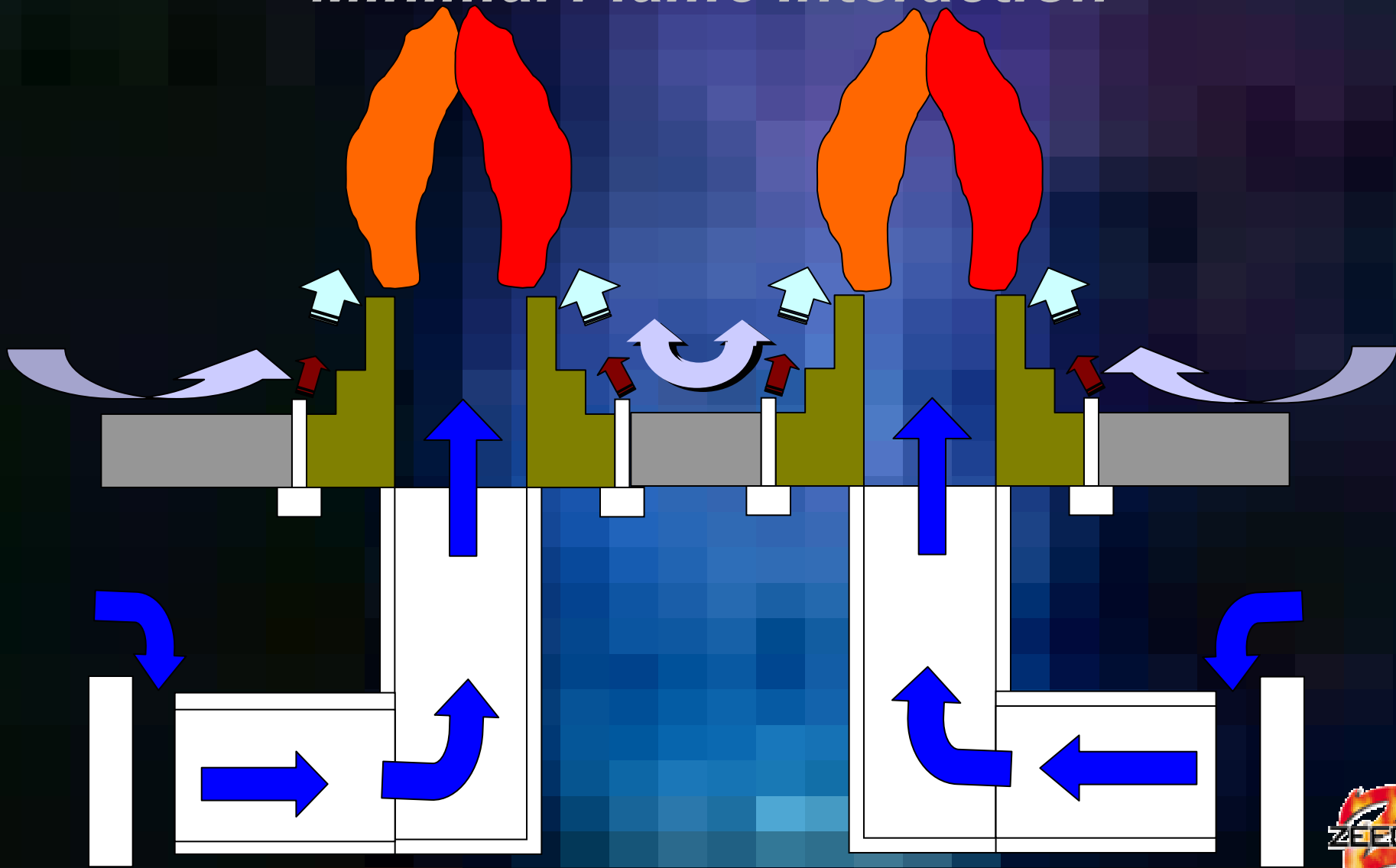
ZEECO BURNER DESIGN CRITERIA

- SHORT FLAME – FREEJET BURNER FLAME CAN BE TAILORED TO MATCH FURNACE CONFIGURATION
- MINIMIZE FLAME INTERACTION – FREEJET BURNER HAS NO SWIRLING OF THE COMBUSTION AIR, WHICH REDUCES POTENTIAL FOR FLAME TO FLAME INTERACTION (INTERACTION CAN LENGTHEN FLAME AND INCREASE NO_x)



Free Jet

Minimal Flame Interaction



ZEECO BURNER DESIGN CRITERIA

- STABLE FLAME – FREEJET BURNER IS THE ONLY “NEXT GENERATION” BURNER THAT CAN FIRE NATURAL GAS TO REFINERY FUEL GAS ON ONE SET OF GAS TIPS AND OFFER UP TO A 10:1 TURNDOWN. PILOT IS OPTIONAL AND NOT REQUIRED FOR STABILITY.
- LONG BURNER LIFE – DURABLE HIGH QUALITY CAST CONSTRUCTION OFFERS LONGER BURNER LIFE



Free Jet

Stable Combustion

After the fuel has been conditioned, combustion occurs on a burner tile ledge in much the same way that raw gas burners have operated for over fifty years. The burner is more stable than that of typical staged fuel gas burners and ultra low emissions burners. Inherent with this high level of stability is turndown ratios from 5:1 to 10:1 for most burner sizes, as well as capability to fire wide range of fuel gases without changing gas tips.



BURNER QUALITY

- ZEECO MAXIMIZES THE USE OF INVESTMENT CASTINGS TO IMPROVE THE QUALITY AND SERVICE LIFE OF OUR BURNERS
- APPROXIMATELY 90% OF THE BURNERS SOLD IN THE PAST YEAR WILL UTILIZE INVESTMENT CASTINGS



EASE OF MAINTENANCE CUSTOMER TESTIMONIAL



The Dow Chemical Company
2001 H. K. Brown Blvd.
Freeport, Texas 77541-3002

November 7, 2002

To Whom It May Concern:

We are writing to confirm that Dow Chemical has selected Zeeco Free Jet burners for a SCORE furnace to be constructed in 2003 at our Freeport, Texas facility. The Zeeco Free Jet burner was selected after extensive evaluation of competing burner technologies.

Based on the preliminary burner testing that we witnessed, we found the Free Jet burner to be highly stable over the required operating range and to produce extremely low emissions without the use of steam injection. We also like the ease with which the Free Jet burner can be disassembled/reassembled for maintenance purposes.

While we have not yet witnessed final burner testing and the burners are not yet in operation in the actual furnace, we are confident in the technology and pleased with the support that Zeeco has provided on this project.

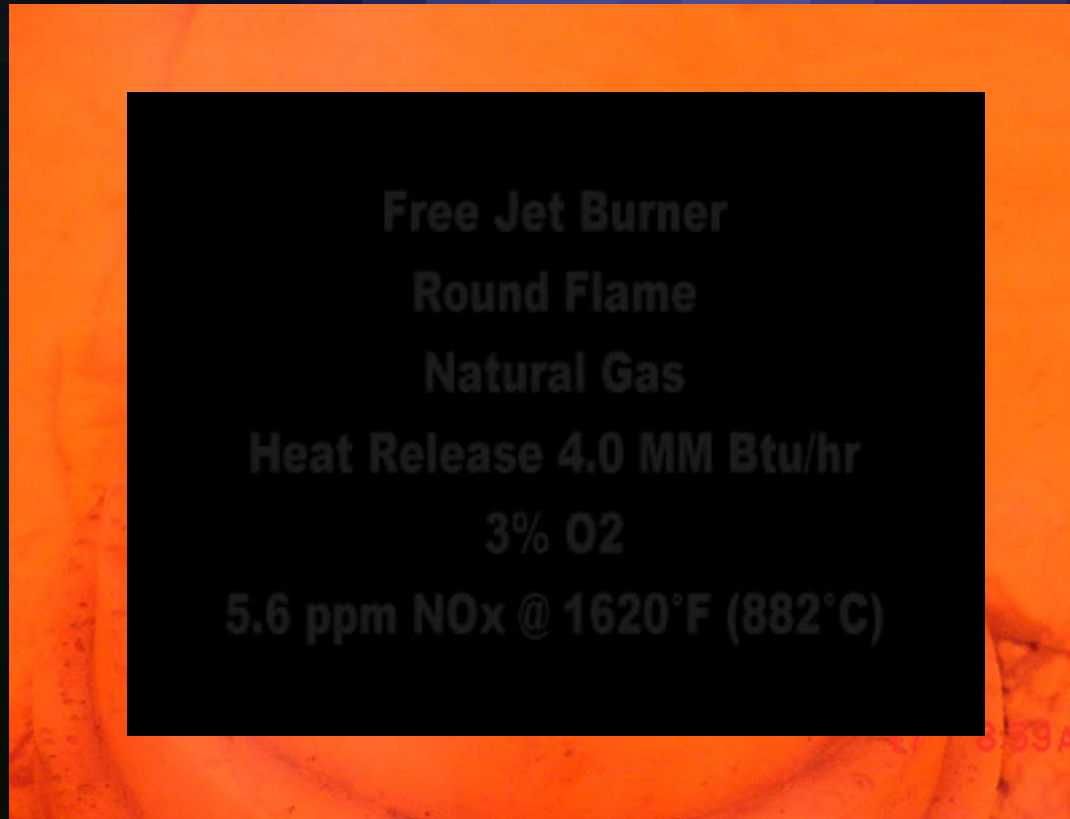
Sincerely,

Sylvester Irving
Manufacturing Representative
Hydrocarbons & Energy
Phone: (979) 238-4374

Terry Brown
LHC-B Project Technician
OCD Unit 6
Phone: (979)-238-7438



Free Jet *Burner*



Round Flame, Free Jet Burner in Operation



IMPROVING THE PREDICTION OF FIELD NOX PERFORMANCE

LARGER, MULTIPLE BURNER TEST FURNACES CAN MORE ACCURATELY SIMULATE ACTUAL PROCESS CONDITIONS AND LEAD TO A GREATER DEGREE OF CERTAINTY IN PREDICTING FIELD NOX AND PROCESS PERFORMANCE.

CFD CAN BE A DIRECTIONALLY USEFUL TOOL IN UTILIZING BURNER DESIGN AND TEST DATA TO IDENTIFY POTENTIAL PROBLEMS IN THE FIELD AND DETERMINE SOLUTIONS



TEST FURNACE No. 12

- DESIGNED FOR MULTI-BURNER TESTING
- HEAT RELEASE UP TO 100 MM BTU/HR
- DIMENSIONS 17.5' DIA. X 40'
- 5.33M X 12.19M
- WATER TUBES FOR FIREBOX TEMPERATURE CONTROL
- FORCED OR NATURAL AMBIENT, PREHEATED AIR OR TURBINE EXHAUST
- BURNER ORIENTATION
 - UP-FIRED



TEST FURNACE No. 13

- DESIGNED FOR MULTI-BURNER TESTING
- HEAT RELEASE UP TO 50 MM BTU/HR (12.6 MM Kcal/HR)
- DIMENSIONS 10' X 27' X 21'
- 3.05M X 8.23M X 6.4M
- WATER TUBES FOR FIREBOX TEMPERATURE CONTROL
- FORCED OR NATURAL AMBIENT, PREHEATED AIR OR TURBINE EXHAUST
- BURNER ORIENTATION
 - HORIZONTAL
 - UP-FIRED



TEST FURNACE NO. 13

FREEJET BURNERS



Free Jet

Field Results

- FIELD RESULTS HAVE BEEN VERY FAVORABLE, MEETING GUARANTEE POINTS TYPICALLY BETWEEN 10-20 PPMV, DEPENDING ON FUEL COMPOSITION AND BOX TEMPERATURE
- CUSTOMER FEEDBACK INDICATES FREEJET BURNER IS LESS SUSCEPTIBLE TO TRAMP AIR NOX INCREASE THAN OTHER BURNERS



FREEJET - COMMERCIALLY PROVEN DESIGN

- OVER 430 SOLD / INSTALLED TO DATE
- PROCESS HEATER APPLICATIONS
- CRACKING FURNACE APPLICATIONS



FREEJET RETROFIT

APPLICATIONS FIELD DATA

| Application | Firing Direction | Firebox Temp | Fuel | NOx (ppmv) |
|-------------|------------------|--------------|------|------------|
| Cabin | Horizontal | 1700 | RFG | 14-18 |
| Cabin | Vertical | 1745 | RFG | 11-13 |
| VC | Vertical | 1450 | RFG | 20 |
| VC | Vertical | 1350 | RFG | 15 |
| VC | Vertical | 1800 | NG | 3-7 |



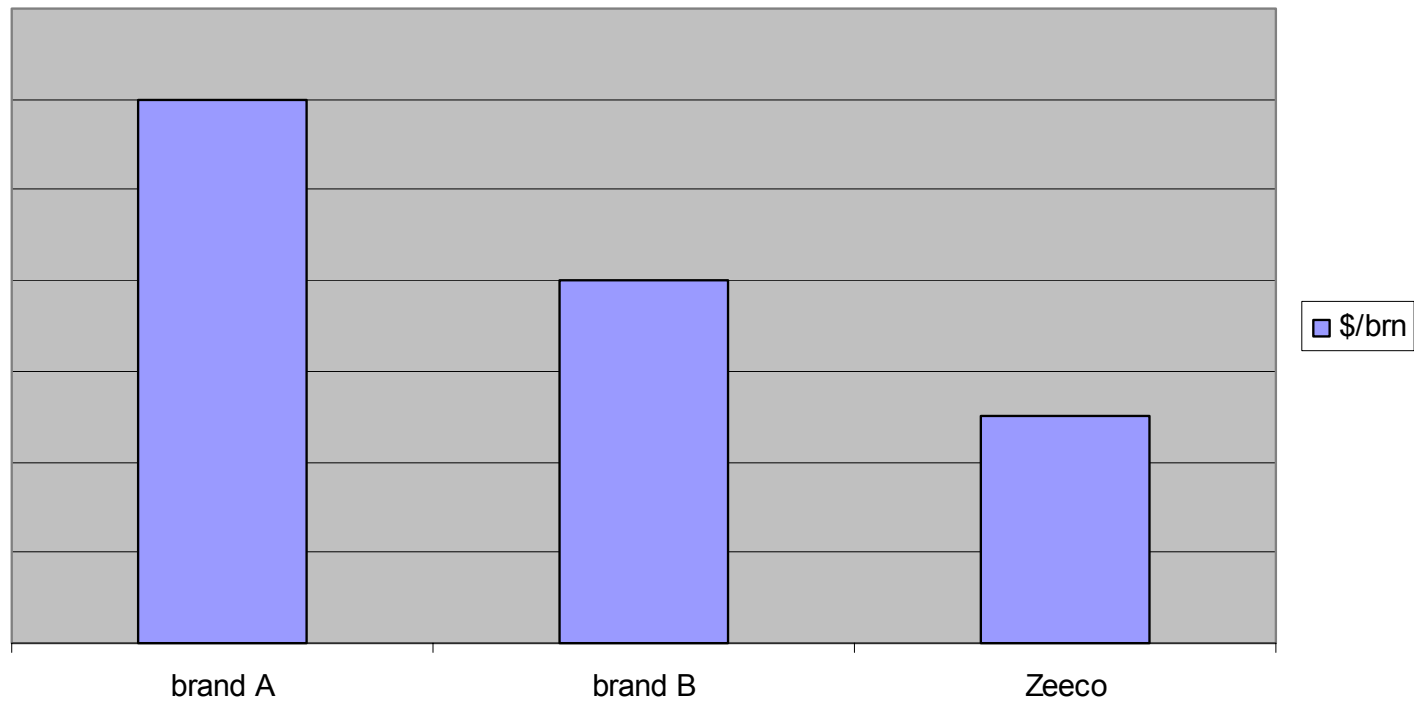
COSTS TO CONSIDER

- EQUIPMENT COST (BURNER PRICE)
- INSTALLATION COST (FLOOR REWORK)
- SPARES COST (LONG TERM COSTS)



AFFORDABLE BURNER PRICING

Burner Price Comparison



ZEECO LOCAL FIELD SUPPORT



Zeeco

NOx Reduction Technology

**For specific questions regarding
Zeeco's Free Jet technology
call us at:**

Ph. 918.258.8551

Fax 918.251.5519

or email us at:

sales@zeeco.com

or on the web at:

www.zeeco.com

